South Fork Coeur d'Alene River Sediment Subbasin Assessment and Total Maximum Daily Load

May 17, 2002

2. Subbasin Assessment – Water Quality Concerns and Status

The South Fork Coeur d'Alene River below the Canyon Creek confluence and several of the stream segments of its watershed are listed as water quality limited under section 303(d) of the CWA. Sediment and metals are uniformly listed as the pollutant of concern except for the East Fork of Ninemile (headwaters to Ninemile Creek) and Milo Creeks. East Fork Ninemile Creek is listed for an unknown pollutant, while Milo Creek is only listed for metals. Canyon Creek is listed for habitat alteration (Table 4). Fish density surveys (URS Grinier 2000a; IDFG, unpublished data; DEQ Beneficial Uses Reconnaissance Program (BURP) data) indicate that these pollutants have contributed to the decline of trout populations in the South Fork and its tributaries. The relative contribution of metals and sedimentation are difficult to separate. The Coeur d'Alene Basin Metals TMDL addresses the metals exceedances caused by these sources (EPA-DEQ 2000).

2.1 Water Quality Limited Segments Occurring in the Subbasin

According to the 1998 list, the South Fork Coeur d'Alene River Subbasin has 14 water quality limited 303(d) listed stream segments for non-metals pollutants, primarily sediment. These are listed and reasons for listing are described in Table 4. The listed segments are mapped in Figure 1. The characteristics of the watersheds are listed in Table 1 (Section 1.2, page 9).

Table 4: Water quality limited segments of the South Fork Coeur d'Alene River Subbasin.

Water Body Name	Segment ID Number	1998 303(d)[1] Boundaries	Pollutants	Listing Basis
SF Coeur d'Alene River	3516	Canyon Ck to Ninemile Ck	Sediment	App A 305(b)
SF Coeur d'Alene River	3517	Ninemile Ck to Placer Ck.	Sediment	App A 305(b)
SF Coeur d'Alene River	3518	Placer Ck. To Big Ck.	Sediment	App A 305(b)
SF Coeur d'Alene River	3513	Big Ck. To Pine Ck.	Sediment	App A 305(b)
SF Coeur d'Alene River	3514	Pine Ck. To Bear Ck	Sediment	App A 305(b)
SF Coeur d'Alene River	3515	Bear Ck. To Coeur d'Alene R.	Sediment	App A 305(b)
Canyon Creek	3525	GorgeGulch. to SF Cd'A River	Sediment; Habitat Alt.	App A 305(b)
Ninemile Creek	3524	Headwaters to SF Cd'A River	Sediment	App A 305(b)
EF Ninemile Creek	5618	Headwaters to Ninemile Ck.	Unknown	BURP Data
Moon Creek	5127	Headwaters to SF Cd'A River	Sediment	App A 305(b)
Milo Creek	5661	Headwaters to SF Cd'A River	Metals	BURP Data
Government Gulch	5084	Headwaters to SF Cd'A River	Sediment	App A 305(b)
EF Pine Creek	3520	Headwaters to Hunter Ck.	Sediment	App A 305(b)
EF Pine Creek	3521	Hunter Ck. To Pine Ck	Sediment	App A 305(b)
Pine Creek	3519	EF Pine Ck to SF Cd'A River	Sediment	App A 305(b)

[1]Refers to a list created in 1998 of water bodies in Idaho that did not fully support at least one beneficial use. This list is required under section 303 subsection "d" of the Clean Water Act.

2.2 Applicable Water Quality Standards

The water quality standards designate both beneficial uses and set water quality standards for the waters of the state. The designated uses for the South Fork Coeur d'Alene Subbasin and the applicable water quality standards appear below.

Designated Beneficial uses

The designated uses in the Idaho Water Quality Standards of the South Fork Coeur d'Alene Subbasin are listed in Table 5. All other water body segments would be protected for those uses attainable. These would be cold water, salmonid spawning and primary or secondary recreation dependent on the indicators of use (Moon Creek; Table 6) (IDAPA 58.01.02.101.01). The EPA has promulgated cold water biota and primary contact recreation as the designated uses for the South Fork Coeur d'Alene River (Canyon Creek to mouth) and (Daisy Gulch to Canyon Creek), Canyon Creek (Gorge Gulch to mouth), and Shields Gulch (mining impact area to mouth) (CFR 40 Part 131 Vol#. 62. #47 July 31, 1997, P.41166)

Table 5: Designated beneficial uses of the water bodies of the South Fork Coeur d'Alene Subbasin (IDAPA 58.01.02.109.09).

Unit	Water Body and Boundaries	Aquatic Life	Recreation	Other	1998 §303(d) List[2]
P-1	SF Coeur d'Alene River - Canyon Ck to mouth		SCR		x
P-2	Pine Creek - EF Pine Ck to mouth	CW; SS	SCR		x
P-3	Pine Ck – source to EF Pine Ck	CW; SS	SCR	DWS	
P-6	Government Gulch – source to mouth	CW; SS	SCR		x
P-7a	Big Creek – source to mining impact area	CW; SS	PCR	DWS	
P-7b	Big Creek – mining impact area to mouth	CW; SS	SCR		
P-8a	Shields Gulch - source to mining impact area	CW; SS	PCR	DWS	
P-8b	Shields Gulch - mining impact area to mouth		SCR		
P-9a	Lake Creek- source to mining impact area	CW; SS	PCR	DWS	
P-9b	Lake Creek- mining impact area to mouth	CW; SS	SCR		
P-11	SF Coeur d'Alene River–Daisy Gulch to Canyon Ck.		SCR		
P-13	SF Coeur d'Alene River – source to Daisy Gulch	CW; SS	PCR	DWS	
P-14	Canyon Creek – Gorge Gulch to mouth		SCR		x
P-15	Canyon Creek – source to Gorge Gulch	CW; SS	PCR	DWS	
P-16	Ninemile Creek from and including EF Ninemile to Mouth	CW; SS	SCR		x
P-17	Ninemile Creek – source to EF Ninemile Ck.	CW; SS	PCR	DWS	x
P-20	Bear Creek – source to mouth	CW; SS	PCR	DWS	

[1]CW – Cold Water, SS – Salmonid Spawning, PCR – Primary Contact Recreation, SCR – Secondary Contact Recreation, AWS – Agricultural Water Supply, DWS – Domestic Water Supply

[2]Refers to a list created in 1998 of water bodies in Idaho that did not fully support at least one beneficial use. This list is required under section 303 subsection "d" of the Clean Water Act.

Table 6. South Fork Coeur d'Alene Subbasin beneficial uses of impaired streams without standards designated uses.

Water Body	Designated Uses[1]	1998 §303(d) List[2]
Moon Creek	CW, SS, SCR	x

[1]CW – Cold Water, SS – Salmonid Spawning, SCR – Secondary Contact Recreation.
[2]Refers to a list created in 1998 of water bodies in Idaho that did not fully support at least one beneficial use. This list is required under section 303 subsection "d" of the Clean Water Act.

<u>Water quality standards</u>

Water quality criteria supportive of the beneficial uses are stated in the Idaho Water Quality Standards and Wastewater Treatment Requirements (DEQ 2000a). The standards supporting the beneficial uses are outlined in Table 7. In addition to these standards cold water and salmonid spawning are supported by two narrative standards. The narrative sediment standard states:

Sediment shall not exceed quantities specified in section 250 and 252 or, in the absence of specific sediment criteria, quantities which impair designated beneficial uses. Determinations of impairment shall be based on water quality monitoring and surveillance and the information utilized as described in Subsection 350 (IDAPA 58.01.02.200.08).

The excess nutrients standard states:

Surface waters of the state shall be free from excess nutrients that can cause visible slime growths or other aquatic growths impairing designated beneficial uses (IDAPA 58.01.02.200.06).

Table 7: Water quality standards supportive of beneficial uses (IDAPA 58.01.02.250.).

Designated Use	Primary Contact Recreation	Secondary Contact Recreation	Cold Water Biota	Salmonid Spawning
Coliforms and pH	406 EC/100mL	576 EC/100mL	pH between 6.5 and 9.5	pH between 6.5 and 9.5
Coliforms and dissolved gas	126 EC/100mL geometric mean over 30days	126 EC/100mL geometric mean over 30 days	dissolved gas not exceeding 110%	dissolved gas not exceeding 110%
chlorine			total chlorine residual less than 19 ug/L/hr or an average 11 ug/L/4 day period	total chlorine residual less than 19 ug/L/hr or an average 11 ug/L/4 day period
toxics substances			less than toxic substances set forth in 40 CFR 131.36(b)(1) Columns B1, B2, D2	less than toxic substances set forth in 40 CFR 131.36(b)(1) Columns B1, B2, D2
dissolved oxygen			exceeding 6 mg/L D.O.	exceeding 5 mg/L intergraval D. O.; exceeding 6 mg/L surface
temperature			less than 22 ^{o}C (72^{o}F) instantaneous; 19 ^{o}C (66^{o}F) daily average	less than 13 ^{o}C (55^{o}F) instantaneous; 9^{o}C (48^{o}F) daily average
ammonia			low ammonia (formula/tables for exact concentration	low ammonia (formula/tables for exact concentration
turbidity			less than 50 NTU instantaneous; 25 NTU over 10 days greater than background*	

* The turbidity standard is a standard applied to the mixing zones of point discharges in the standards (IDAPA 58.01.02.250.01.d.) However, the standard is technically based on the ability of salmonids to sight feed. For this, it is applicable through the narrative sediment standard (IDAPA.0.02.200.08) to impacts on salmonids (cold water biota) wherever these may occur. Abbreviations: pH – negative logarithm of the hydrogen ion concentration; E. Coli - *Escherichia coli;* ug/L – micrograms per liter; D.O. – dissolved oxygen; mg/L – milligrams per liter; ^{o}C – degrees centigrade; ^{o}F – degrees Fahrenheit; NTU – nephlometric turbidity units.

2.3 Summary and Analysis of Existing Water Quality Data

Metals impair the South Fork Coeur d'Alene River. The CERCLA issues has fostered the collection of a great deal of discharge, water quality, and beneficial use support data. The metals data are summarized in the South Fork Coeur d'Alene Subbasin Assessment addressing metals (DEQ 1998) and in the Coeur d'Alene Basin Remedial Investigation (URS Greiner 2001a). The Metals Concentration Probabilistic Model Technical Memorandum best summarizes these data (URS Greiner 2001b). The remedial investigation developed additional discharge and sediment yield data of value to this assessment. DEQ and others have collected a considerable amount of beneficial use status data. These data are covered below and address both listed and unlisted waters.

Flow Characteristics

The U.S. Geological Survey has continuously operated the Pinehurst Gauging Station since August 1987. The average annual discharge hydrographs of the stations indicate the spring snowmelt event dominates the pattern of stream discharge (Figure 5). Mean high flow discharge occurs in April at 1,350 cubic feet per second (cfs), and mean low flow discharge in September at 114. A more intermittent feature observed on individual yearly discharge hydrographs is rain on snow events precipitated by the climate factors discussed earlier (Figure 6). These events occur between November and March with some years having more than one occurrence and others with none. Rain on snow conditions often result in large discharge (flood) events.

Figure 5: South Fork Coeur d'Alene River Pinehurst ID average monthly discharge (cfs) for water years 1996-2000 (USGS 1996-2001)

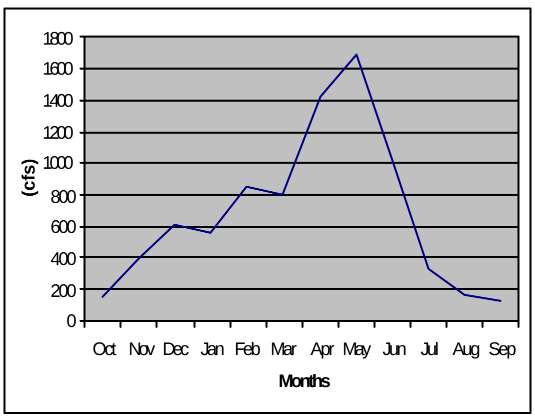
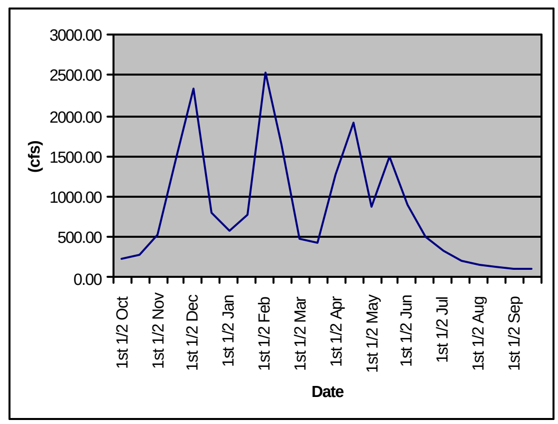


Figure 6: South Fork Coeur d'Alene River near Pinehurst ID average biweekly discharge (cfs) for water year 1996 (USGS 1997)



The maximum period of record for any station in the South Fork Subbasin is 33 years (Placer Gage), while that for the North Fork Coeur d'Alene River is 61 years (Enaville Gage). A flood frequency analysis was developed for the North Fork Coeur d'Alene River and the Coeur d'Alene River based on the long-term stream gages (DEQ 2001c). The South Fork Subbasin receives the identical weather systems, has similar geologic history, has less area in the elevation zone subject to rain on snow effects, and has less area harvested by clear-cut methods. The flood frequency analysis developed for the North Fork Coeur d'Alene Subbasin is applicable to the South Fork Coeur d'Alene Subbasin.

Based on the flood frequency analysis developed for the North Fork, large discharge events occur every 10 to 15 years. The flood frequency and history indicate that clear-cut logging practices have not altered the discharge frequency or discharge magnitude. First and second order stream discharge could be altered by vegetation harvest or land clearing. If this effect occurs, it is desynchronized basin-wide. These results are applicable to the South Fork Subbasin that has sustained a much lower intensity of clear cut logging.

Water Column Data

Water quality data on the metals have been assessed in subbasin assessment addressing the metals contamination issue (DEQ 1998) and the Superfund remedial investigation (URS Greiner 2001a). DEQ and USGS have measured some water quality parameters, in addition to metals. Parameters such as pH, temperature, dissolved oxygen, plant growth nutrients, and conductivity have been measured. Except for metals and some temperature measurements, standards and guidelines are not exceeded for these parameters. Sufficient temperature data has not been collected to make a judgement of temperature exceedances. A metals TMDL has been developed for the entire Coeur d'Alene Basin (DEQ-EPA 2000). Therefore, the existing water column data is not important to sediment impairments.

Biological and Other Data

The existing biological data reflects impacts from metals pollution as well as from sediments. It is often difficult to separate the impacts of these two pollutants with biological data, because the metals and much of the sediment have origins either at the mine sites or in infrastructure built to support the mines.

Biological data provides the most direct measurement of the status of the cold water use, while habitat data provides an assessment of the habitat parameters that can affect that use independent of pollutants of concern. Biological and habitat data collection and analysis do have limitations. These limitations are more fully discussed in the methods and interpretation manuals (EPA, 1999; DEQ, 2002).

- Macroinvertebrate and Habitat Index data

Macroinvertebrate biotic indices (MBI) and habitat indices (HI) are provided in Table 8 for several water bodies of the South Fork Coeur d'Alene River watershed. An MBI score of 3.5 indicates a relatively healthy macroinvertebrate community. The tributaries that are not affected by metals have MBI scores well above 3.5. Tributaries on which mining and milling have occurred have high scores above the mining impacts, but these generally decline below the mining impacts (Canyon and East Fork Ninemile Creeks). The exceptions are Pine, East Fork Pine, Highland, and Moon Creeks, which have scores higher than 3.5. The scores are higher in the South Fork above Wallace than down stream. However, macro-invertebrate communities recovered somewhat, since the surveys of Clark (1992) and Terpening, Hornig, and Bogue (1986).

Habitat indices for the South Fork tributaries do not exceed 70 in most cases. The HI scores remain high above mining impacts but decline in those stream reaches affected by mining impacts. These declines in habitat quality are associated with loss of the riparian communities along the streams as a result of mining and development impacts. The HI scores are low as well due to sedimentation impacts on the stream channels.

- Fisheries data

The fisheries data collected in the BURP (DEQ), data from studies by Hartz (Hartz 1993a; 1993b), IDFG, Natural Resource Damage Assessment, and USGS (URS Greiner, 2001c) are provided in Table 9. Tributaries that are not contaminated with metals indicate salmonid densities of 0.1-0.3 or greater fish per square meter. This density is indicative of full support, based on other control areas in the Panhandle Region (DEQ 2000c). Three age classes are present indicating reproduction. Presence of sculpin and tailed frogs bolster the full support conclusion. Sculpin were not found in tributaries with some metals contamination (Highland, Lake and Moon Creeks). Age class distribution and trout density decline in tributaries with high levels of metals contamination (Canyon and Ninemile Creeks). The South Fork below Wallace has low salmonid densities. Salmonid are generally adult or juvenile fish. Sculpin and tailed frogs are generally not found in the river below the Canyon Creek confluence. The fisheries data indicates healthy fisheries in the tributaries and above mining impacts that is not affected by metals contamination. The fishery is impaired below the mining impacts. Comparison of fisheries data collected in 1993 to that collected in 1999 and 2000 does not indicate that fish density has increased in the South Fork below Wallace or in Canyon and Ninemile Creeks.

Table 8: Macroinvertebrate Biotic Index and Habitat Index data of the South Fork Coeur d'Alene Subbasin.

Stream	WBID Number in Subbasin 17010302	MBI	HI
Bear Creek	020	5.14	73
Big Creek	007	5.13	73
Calusa Creek	003	4.66	65
Canyon Creek (Lower)	014	1.92	34
Canyon Creek (Upper)	015	5.27	74
Denver Creek	004	3.86	32
E.F. Ninemile Cr (Lower)	016	2.86	30
E.F. Ninemile Cr (Upper)	016	4.66	51
E.F. Big Creek	007	4.81	67
EF Pine Creek (Lower)	004	4.01	33
EF Pine Creek (Upper)	004	4.00	58
Government Gulch	006	2.67	22
Highland Creek (Lower)	004	4.27	38
Highland Creek (Upper)	004	4.98	77
Hunter Creek	005	3.76	69
Lake Creek	009	4.08	52
LT N.F. of S.F. CdA R.	013	4.65	77
Milo Creek	001	N.D.	19
Moon Creek (lower)	008	3.63	58
Moon Creek (Upper)	008	3.22	57
Nine Mile Creek (Upper)	016	4.44	54
Pine Creek (Upper)	002	3.58	26
Placer Creek	010	5.31	66
SF CdA R. (Shoshone Pk)	013	4.18	53
SF CdA R. (below Canyon)	001	3.67	50
SF CdA R. (Wallace)	001	3.74	53
SF CdA River (Osburn)	001	3.95	49
SF CdA River (Liz Park)	001	4.06	54
Terror Gulch	001	4.34	62
Trapper Creek	005	4.45	72
Two Mile Creek (Lower)	001	4.84	53
Two Mile Creek (Upper)	001	4.92	56
West Fork Moon Creek	019	4.68	70

WBID – water body identification number; MBI – macroinvertebrate biotic index; HI – habitat index; EF – East Fork; SF – South Fork; R. - River; Lt. – Little.

Table 9: Fish density data of the South Fork Coeur d'Alene Subbasin.

Stream	Site	Date	Salmonid Density (fish/m²/hr effort)	Presence of Three Salmonid Age Classes	Sculpin Density (fish/m²/hr effort)	Presence of Tailed Frogs
Bear Creek [1.]	Lower	07/01/98	0.4902	Yes	1.1765	Yes
Big Creek [1.]	Lower	10/28/97	0.1176	No	0.4706	No
Calusa Creek [1.]	Lower	07/01/98	0.0108	No	0.7474	Yes
Canyon Creek [5.]	Near Burke	8/2000	0.044	Yes	0.291	Yes
Canyon Creek [5.]	Near Woodland Park	8/2000	0	No	0	No
EFNine Mile Ck[2.]	ENM-5	09/12/95	1.1409	Yes	0	No
EFNineMile Ck. [6.]	below Interstate	07/11/95	0	No	0	No
EF Big Creek [1.]	Lower	08/21/97	0.0237	Yes	0.0995	No
EF.Big Creek [1.]	Lower	06/29/98	0.0231	Yes	0.2276	Yes
EF Pine Creek [1.]	Upper	06/23/98	0.0451	No	0.5156	Yes
EF Pine Creek [5.]	above Nabob	8/2000	0.256	Yes	NA	NA
Highland Ck [1.]	Upper	06/24/98	1.2500	Yes	0	Yes
Lake Creek [1.]	Lower	10/25/97	0.2252	Yes	0	No
Lt N.F. of S.F. CdA River [1.]	Lower	07/12/99	N.D.	No	0.1953	No
Moon Creek [1.]	Upper	07/08/97	0.2316	Yes	0	Yes
Nine Mile Ck [2.]	NP-P2	09/12/95	2.0221	No	1.7157	No
Nine Mile Ck [2.]	NP-P1	09/12/95	1.5625	Yes	0.5208	No
Pine Creek [6.]	below Amy	8/2000	0.086	Yes	NA	NA
SF CdA River [2.]	Pine Ck to Mouth	07/26/93	0.0044	Yes	0	NA
SF CdA River [2.]	Pine Ck to Mouth	08/13/93	0.0020	Yes	0	NA
SF Cd'A River [5.]	Near Pinehurst	8/2000	0.003	No	NA	NA
SF CdA River [4.]	Elizabeth Park	Aug-93	0.0014	Yes	0	NA
SF CdA River [1.]	Above Wallace	08/20/98	0.0947	No	0	NA
SF CdA River [1.]	Big Creek to Pine Creek	08/19/98	0.0037	No	0	Yes
SF CdA River [1.]	Canyon Ck to Ninemile Ck	08/19/98	0.0085	No	0	Yes
SF CdA River [1.]	Ninemile Ck to Placer Creek	08/19/98	0.0085	No	0	Yes
SF CdA River [1.]	Placer Creek to Big Creek	08/19/98	0.0219	No	0	NA
Trapper Creek [1.]	Lower	06/25/98	0.0793	Yes	0.5549	Yes
Two Mile Creek [1.]	Upper	06/29/98	0.6838	Yes	4.4160	No

Note: 1.–IDEQ BURP data; 2.-IDEQ Hartz 1993a; 3.-IDEQ Hartz 1993b; 4.-IDFG; 5.-USGS; 6.-NRDA; N.A. – not assessed.

- Sedimentation Data

Inspection of the South Fork and the Coeur d'Alene River provides abundant evidence suggesting bed load sediment has increased in the South Fork. Numerous large alluvial bars are present in the South Fork below the Canyon Creek confluence. Newly deposited bars are present along the floodplain of the South Fork. The gravel and cobble in transport is deposited eventually at the grade break in the river system that is located in the Coeur d'Alene River between Kingston and Cataldo. In this reach of the Coeur d'Alene River the channel is braided through the deposited alluvium. Historical descriptions of the Coeur d'Alene River do not include the current sediment bars and braided channels (Russell 1985). The fine sediment is primarily silt. This sediment is rapidly mobilized in the higher gradient channels (Rosgen B) of the subbasin for deposition down stream in the Coeur d'Alene River (USDA 1994).

Riffle Armor Stability Indices

A more quantitative index of streambed instability is the riffle armor stability index (RASI)(Kappesser 1993). The measurement consists of a 200 particle count and size measurement on a transect across a stream riffle using the methods of Wolman (1954). With this information, a particle size distribution curve is developed for the riffle. A RASI involves an additional measurement of the thirty largest particles found deposited on the point deposition bar located immediately downstream of the riffle. The RASI value is the percentage of particles in the distribution curve smaller than the mean size of the largest particles deposited on the point bar. Since the largest particles on the point bar represent the largest stream bed particles moved by the stream during the most recent channel altering event, the RASI provides an assessment of the percentage of the stream bed materials mobilized during the event. A RASI value provides an assessment of relative streambed stability. Values in the range of 28-60 with a mean of 44 have been found in non-managed streams of the upper St. Joe River basin, which are believed to have high relative stability. These watersheds have very few or no roads, virtually no timber harvest and the last general disturbance of the area was the 1910 wildfire. Streams of managed watersheds with appreciable forest harvest and road infrastructures provide RASI values in the range of 66-99 with a mean of 82. These streams are believed to have streambed instability (Cross and Everest 1995; DEQ 2000b).

Riffle armor stability was measured on several tributaries to the South Fork by the Forest Service (Lider, unpublished data) and DEQ (Hartz 1993b). These measurements are summarized in Table 10. Riffle armor stability measurements are uniformly high with the lowest mean value at 75. These measurements are indicative of instability of the streambeds of the tributaries.

Residual Pool Volume

The amount of pool volume in streams can be estimated using residual pool volume measurements. Residual pool volume is the volume a stream pool would occupy if the stream reached a zero discharge condition. Under this condition, water would not flow over stream riffles, stream runs would hold little water, and the pools would make up the majority of the wetted volume of the stream. Residual pool volume is calculated using a box model from measurements of average pool depth, average pool width, pool length, and average pool

Table 10: Riffle armor stability indices for segments of the South Fork Coeur d'Alene River Subbasin.

Stream	WBID Number in 17010302	RASI Range	RASI Mean	Data Source
Bear Creek	020	97-99	98	IDEQ
Pine Creek	001	96-100	98	IDEQ
East Fork Pine Creek	004	96-97	96	IDEQ
Trapper Creek	005	92-97	95	IDEQ
Montgomery Gulch	001	96-98	97	IDEQ
Moon Creek	008	87-96	90	IDEQ
Two Mile Creek	001	60-86	75	USFS
Lake Creek	009	78-100	88	USFS
Placer Creek	010	88-94	90	USFS
Nine Mile Creek	016	77-92	84	IDEQ
Canyon Creek	015	93-96	94	IDEQ

Note: RASI data developed by U.S. Forest Service (Lider, unpublished data) or DEQ (Hartz 1993b).

tail out depth. Average pool tail out depth is subtracted from average pool depth to develop the third side of the box model. Residual pool volume is normally developed for a reach of stream a multiple of 20 times the bank full width in length. The values are normalized on the basis of pool volume per mile of stream. Residual pool volume increases with stream width. For this reason, residual pool volume values must be stratified by stream width to assess the relative amount of pool volume.

Residual pool volume data for the water quality limited segments has been stratified by bank full stream width (Table 11). Pool volume data of reference streams, which have low road densities, are provided for each stratification class allowing the interpretation of the values of the water quality limited segments. Reference streams in the North Fork Coeur d’Alene River watershed are included in the Table 11 (bold). These streams have few impacts and generally high fish densities.

The residual pool volume of most segments is low as compared to reference streams. Values of most South Fork stream segments are approximately ten fold lower than the reference streams. The exceptions are Big Creek, Pine Creek, and the South Fork Coeur d’Alene River. These streams have lower residual pool volume, but by less than ten fold. The residual pool volume data indicates that sedimentation by large particles (cobble) has caused pool filling.

Table 11: Residual pool volume for segments of the South Fork Coeur d'Alene River Subbasin.

STREAM	Bank Full WIDTH (ft)	RESIDUAL POOL VOLUME (ft3/mi)
GOVERNMENT GULCH	4.80	924
MCFARREN CREEK	5.00	1330
MOON CREEK	6.80	3070
SPRUCE CREEK	**8.00**	**19091**
NINEMILE CREEK	8.26	1848
MONTGOMERY GULCH	8.60	5111
TWOMILE CREEK	10.09	1465
WEST FORK MOON CREEK	11.81	1118
HUNTER CREEK	12.17	3238
BEAR CREEK	12.41	1824
BUCKSKIN CREEK	**12.60**	**24345**
PLACER CREEK	13.21	1517
TRAPPER CREEK	13.67	4955
DENVER CREEK	13.89	308
CANYON CREEK	14.50	2871
LAKE CREEK	15.12	1096
LITTLE NORTH FORK SOUTH FORK CDA RIVER	17.36	1639
HIGHLAND CREEK	19.07	668
EAST FORK PINE CREEK	20.12	1266
INDEPENDENCE CREEK	**20.40**	**79701**
EAST FORK BIG CREEK	22.53	2292
NORTH FORK CDA RIVER	**23.90**	**41099**
PINE CREEK	25.50	13528
CALUSA CREEK	25.59	2910
BIG CREEK	25.75	10635
SOUTH FORK CDA RIVER	29.23	45354

Measured Estimate of Sediment Load

The U.S. Geological Survey used in-stream measurements to estimate sediment load passing several stations in the South Fork during water year 1999 for the Coeur d'Alene Basin Remedial Investigation and Feasibility Study (URS Greiner 2001a)(Table 12). Data on the size fraction of the sediment load is available for three tributaries.

Table 12: Sediment estimates for gauging stations in the South Fork Coeur d'Alene River Subbasin for water year 1999.

Stream	Gage location	Total sediment (tons/mi^2)	Fines (tons/mi^2)	Sand (tons/mi^2)	Coarse (tons/mi^2)
Canyon	Mouth	62	32	27	3
Ninemile	Near mouth	34	14	11	9
Pine	Above Pinehurst	37	5	7	26
SF Cd'A River	At Silverton	51*	-	-	-

Estimate tons per square mile ((tons/mi^2) based on 1999 in-stream sediment data and discharge records for water years 1980-1985.

These data are in-stream estimates for a single year. Water year 1999 was statistically average for water yield and did not have large discharge events that would cause movement of large parts of the coarse bed load. Larger estimates would have been developed in years with large discharge events. Some of these data were collected when remedial actions were disturbing the upstream bed (Canyon Creek), while others were collected after recent removals (Ninemile Creek). The preponderance of the fines and sand fraction in the Canyon (95%) and Ninemile (74%) data suggests the problem. Gravel and cobble are the predominant fraction in the streambeds, but is not the predominant fraction detected. Pine Creek sediment is predominantly coarse as expected.

Point Sources of Sediment

Ten permitted discharges have total suspended solid limits ranging from 20 to 70 mg/L. These sources discharged a total of 73.9 tons per year of sediment to the stream based on 1999 and 2001 discharge monitoring records (DMR) (Table 13). All of this sediment is fine material that does not cause pool filling. The sediment from wastewater treatment facilities (50.7%) contains organic matter that is likely a benefit to the South Fork, which has little organic matter input from its impaired riparian communities.

Sediment Modeling

Sediment monitoring in-stream is a very time consuming and costly undertaking. The in-stream sediment data collected by the USGS during four synoptic events in water year 1999 cost $75,000. Sediment monitoring should be conducted for seven years at a site to develop a database that accounts for the variance of discharge affects on sediment yield and transport from year to year. The investment required to conduct sediment monitoring is estimated at $131,250 per site. The time necessary and costs involved do not make sediment monitoring a viable approach. A sediment modeling approach uses coefficients developed over long periods in paired watersheds. A sediment modeling approach is the most time and cost efficient approach to estimating sediment for the purposes of TMDLs.

Table 13: Permitted sediment discharges to the South Fork Coeur d'Alene River Subbasin.

Permitted Discharge	Average[1] Discharge (MGD)	Average Supended Solids Discharged (mg/L)	Average Daily Sediment Load (lb/d)	Average Annual Load (tons/yr)
Page	2.20	10.2	186.8	34.1
Mullan	0.24	4.1	8.2	1.5
Smelterville	0.12	11.0	11.0	1.9
Coeur/Galena 001	0.91	3.2	24.2	4.3
Coeur/Galena 002	0.42	2.1	7.3	1.3
Coeur/Caladay	0.18	0.7	1.0	0.2
Lucky Friday 001	1.06	4.1	36.2	6.8
Lucky Friday 003	0.97	2.6	21.0	3.9
Sunshine	1.17	6.0	58.4	12.6
Central Treatment Plant	2.20	2.1	38.5	7.3
Total	9.47	-	392.6	73.9

[1] data from DMR for 1999 through 2001.

Land Use Data

Sediment loading occurs from the entire watershed. It is not necessarily restricted to the water quality limited segments of the South Fork Coeur d'Alene River Subbasin. In the following tables, sediment load is analyzed based on all contributing watersheds to the subbasin. Sediment yield is estimated from land use data developed from U.S. Forest Service (USFS) and IDL geographic information system (GIS) timber stand coverage and delineation of urban-suburban lands along the river bottom. Fire and road coverages developed by the USFS and Bureau of Land Management (BLM) were used to develop data on areas that received two wildfires and the forest road mileage and densities. After assessment by IDL specialists, cumulative watershed effects (CWE) scores and land failure yield estimates were developed. Highway land use acreage was estimated based on the road length (GIS road coverage) and the known right of way width. Mine waste pile area and length of stream encroachment was developed from BLM coverages of mine waste deposits. These values are reported on Table 14.

Table 14: Land use of watersheds of the South Fork Coeur d'Alene River Subbasin.

Watershed	**Upper SF Cd'A**	**Canyon Creek**	**Ninemile Creek**	**Placer Creek**	**Middle Gulches**	**Big Creek**	**Terror Gulch**	**Moon Creek**	**Montgomery Creek**	**Lower Gulches**	**Pine Creek Headwaters**	**EF Pine Creek**	**Pine Creek Sidewalls**	**Bear Creek**
Conifer forest (acres)	31,735	12,132	6,803	10,011	13,905	20,197	1,600	4,752	3,778	6,922	15,724	16,102	9,304	6,623
Non-stocked forest (acres)	178	1,407	447	0	2,608	548	270	884	930	7,261	2,513	3,089	3,189	581
Double Wildfire Burn (acres)	25.4	0	0	5,560	0	2,865	0	308	0	0	157	1,513	0	0
Urban-Suburban (acres)	206	20.8	2.7	10	1,252.1	154	11.3	3.3	88.6	2,322.4	0	0	544.8	0
Highway (acres)	482.9	151.0	63.2	21.8	613.6	208.2	34.3	96.0	119.1	701.0	0	34.4	284.1	14.2
Forest road (miles)	180.7	92.8	66.7	41.4	97.2	88.7	11.9	22.4	31.5	120.7	84.8	63.6	118.2	48.7
Average road density (miles/mile^2)	3.5	4.3	5.8	2.6	3.4	2.7	3.9	2.5	4.1	4.5	3.0	2.1	5.7	4.3
Road Crossing Number	163	114	62	37	99	53	7	15	28	109	47	43	81	37
Road Crossing Frequency	1.5	2.7	2.9	1.0	1.5	0.7	0.8	0.7	1.4	1.4	1.0	0.6	1.6	1.6
Encroaching road (miles)	6.5	4.4	4.0		5.9	4.0	0.5	0.9	1.1	6.2	1.9	2.9	2.7	1.7
CWE Score	16.5[1]	17.8	15.5	16.5[1]	10.3	10.0[1]	9.9	9.9	11.9	13.4	28	11.7	11.4	10.2
Encroaching mine waste piles (miles)	0.1	2.2	1.2	0	2.6	0	0	0.3	0	0.2	0	2.4	0.2	0
Mine waste piles (acres)	9.4	75.9	39.4	0	140.2	0	1.0	8.1	0	14.2	0.2	63.4	7.5	0

Data taken from CDASTDS, IDPNFIRE, CDAROADS, and IDL databases cut for specific sub-watersheds. [1]Assumed value from adjacent watersheds

Sediment Yield and Export

Sediment yields were developed separately for forest, mined, and urban land types (Table 15). Sediment contribution from road surfaces, mass failures, road encroachment, and stream bank erosion were modeled with a separate set of algorithms. Mining features such as tailings ponds and waste rock piles that encroach on the stream channels and floodplains were treated as encroaching roads. Sediment yield to the stream system was assumed to be 100%. Model assumptions and documentation of the sediment model are provided in Appendix A.

Direct delivery of sediment from stream bank erosion is not a large factor in the Rosgen B channels of the South Fork Coeur d'Alene Subbasin (Golder, 1998). The model reports this factor as zero. No grazing is practiced in the subbasin and features that formerly had bank erosion (tailings deposits) have been removed in recent years. Bank and bed erosion does occur where roads and towns encroach on the floodplains. These areas are treated in the model with the estimation of sediment yield caused by encroaching features.

Table 15: Estimated sediment yield coefficients for forestland, mined lands, and highways uses on the Belt Super-group terrain.

Landuse type sediment export coefficient	**Belt Super-group precambrium meta sediments**
Unconfined mill tailings deposits (tons/acre/year)	0.100
Conifer forest (ton/acre/year)	0.023
Non-stocked forest and waste rock piles (tons/acre/year)	0.027
Double wildfire burn (ton/acre/year)	0.004
Urban-Suburban (ton/acre/year)	0.050
Highway (tons/acre/year)	0.019

Sedimentation Estimates

Sedimentation estimates were developed by addition of the various sediment yields prorated for delivery to the channels (Table 16). Copies of the Excel model spreadsheets are available in Appendix B.

Table 16: Estimated sediment delivery to the South Fork Coeur d'Alene River Subbasin.

Watershed	Upper SF Cd'A	Canyon Creek	Ninemile Creek	Placer Creek	Middle Gulchs	Big Creek	Terror Gulch	Moon Creek	Montgomery Creek	Lower Gulches	Pine Creek Headwaters	EF Pine Creek	Pine Creek Sidewalls	Bear Creek
Conifer forest (tons/year)	729	279	156	230	320	465	37	109	87	159	362	370	214	152
Unstocked Forest (tons/year)	5	38	12	0	70	15	7	24	25	196	68	83	86	16
Unconfined mine waste pile erosion (tons/year)	1	8	4.0	0	14	0	0	1	0	1	0	6	1	0
Urban-Suburban (tons/year)	10	3	1	0	63	8	1	0	4	116	0	0	27	0
Highways (tons/year)	9	3	1	0	12	4	1	2	2	13	0	1	5	0
Double Wildfire Yield (tons/year)	0	0	0	22	0	11	0	1	0	0	1	6	0	0
Road Crossings (tons/year)	44.5	35	16	10	17	9	1	4	6	26	32	8	15	6
Road Failures (tons/year)	0	0	0	0	0	0	0	0	0	0	928	0	0	5
Road & Mine encroachment (tons/year)	89	80	52	37	158	60	4	11	9	145	22	67	36	26
Total (tons/year)	889	443	241	301	654	571	51	152	133	657	1412	542	385	194

Total estimated annual sediment delivery to the South Fork Coeur d'Alene River from nonpoint sources is 6,623 tons per year. The total sediment load is 6,699 tons per year, when the permitted discharge load is added. The natural background sediment yield is based on the assumption that the watershed is forested in at least seedling and sapling trees. The mid-range value of the sediment yield coefficient is multiplied by the entire watershed acreage to develop a background sediment yield of 4,399 tons per year. An annual excess of 2,300 tons of sediment per year is estimated by this method to be delivered to the river. The sedimentation for the entire watershed is 52% above estimated natural sedimentation. The percentage above background sedimentation for major watersheds ranges from 15% to 237% (Table 17). Sedimentation rates in excess of 50% of natural sedimentation may be sufficiently high to exceed water quality standards (Washington Forest Practices Board 1995). The value is deceiving, because it has been annualized. Massive sediment delivery to the system occurs during high discharge events typically associated with rain on snow conditions. These events have 10 to 15 year return times. It is a better estimate that 23,000 to 34,500 tons of excess sediment are delivered to the river during some single large events. The river exports the sediment during the periods between the large discharge events.

Table 17: Estimated background and sediment delivery to sub-watersheds of the South Fork Coeur d'Alene River Subbasin.

Watershed	**Upper SF Cd'A**	**Canyon Creek**	**Ninemile Creek**	**Placer Creek**	**Middle Gulchs**	**Big Creek**	**Terror Gulch**	**Moon Creek**	**Montgomery Creek**	**Lower Gulches**	**Pine Creek Headwaters**	**EF Pine Creek**	**Pine Creek Sidewalls**	**Bear Creek**	**SF Cd'A River**
Total Nonpoint Source sediment (Tons/year)	889	443	241	301	654	571	51	152	133	657	1412	542	385	194	6625
Sediment Discharged	12.2	0	0	0	18.4	0	0	0	0	43.6	0	0	0	0	74
Total Sediment	901	443	241	301	672	571	51	152	133	701	1412	542	385	194	6699
Background sediment yield (Tons/year)	750	317	168	231	426	486	44	132	113	396	420	334	307	166	4399
Percent above background	20.2	39.7	43.4	30.2	57.8	17.6	14.8	15	17.7	76.9	236.7	22.1	25.4	16.7	52.2

Canyon, Ninemile, and Pine Creeks have modeled sediment yield per square mile of 21, 21, and 25 tons per square mile, respectively. The USGS measured sediment yield in these watersheds during water year 1999 (URS Greiner 2000a) (Table 12, page 30). The measured values in Table 12 are of the same range as the model predictions, but the modeled predictions are 1.5 to 3 times lower.

There are two explanations for the differing results between in-stream estimates (Table 12) and model estimates (Table 17). In-stream sediment data was collected as remedial work proceeded in Canyon Creek (1999) and only a few years after remedial actions in Ninemile Creek. These actions included considerable disturbance of the streambed. The high percentage fines and sand in the Canyon (95%) and Ninemile (74%) suggest this explanation. Sediment yielded to streams by the predominant erosion mechanisms is primarily coarse material in these watersheds. The sediment load composition is more typical of Pine Creek, where 32% of the sediment was fines and sand. The second explanation is reduced yield in recent years. The remedial actions described in Section 4 (page 42) were implemented to reduce metals, but had an added result of sediment yield reduction. The removal and stabilization of tailings piles and waste rock at the Interstate, Success, Gertie, and several other sites, the capping of tailings piles and the removal of tailings contaminated sediments from at least 12 miles stream shore have reduced sediment yield to the streams. The BLM mine features database provided sediment yields from mine waste piles and contaminated sediment model inputs. The inputs were updated to take into account the remedial actions described in Section 4. Since these actions have occurred in the past eight years, the actual transport of sediment measured in-stream may not yet reflect the lessened sediment yield of the landscape.

The model results only estimate the delivery of sediment to the river system. The transport of sediment in the South Fork watershed and export of sediment from the watershed is not addressed. The riffle armor stability and residual pool volume data indicate the current sediment load destabilizes the channels. Sediment loads associated with the large fire event of 1910 are likely still present to some extent in the channels. Alterations of floodplain function in many locations have removed the buffering capacity of the channel system. Even after sedimentation rates to the watercourses are reduced dramatically, it will take a substantial period (10-50 years) for the current sediment load of the river to be exported or placed in stable deposits.

Status of Beneficial Uses

Impairment of cold water biota and salmonid spawning in the South Fork Coeur d'Alene River and some of its tributaries by the metals and sediment loads is indicated by the fish density and age class data. Metals and sediment impacts to the beneficial of the listed waters cannot be completely segregated. However, the residual pool volume data demonstrate that excess sedimentation is part of the problem. Sediment is filling pools to the detriment of the trout. The sediment monitoring data at selected locations in the South Fork watershed indicates that in stream sediment load even during an "average" year is 1.5 to 3 times the background level of sediment yield. Sediment modeling of the basin supports this conclusion. The biological and sedimentation data indicate that the listed segments of the South Fork Coeur d'Alene River and its tributaries with the exception of Moon Creek are limited by excess sedimentation. Fish density, residual pool volume, and sediment model data do not indicate a sediment limitation of Moon Creek. Since sediment is yielded to the lower segments of the South Fork from its entire watershed, the sediment TMDL must address the entire watershed.

Conclusions

All sediment-listed segments of the South Fork Coeur d'Alene River Subbasin are impaired by excess sedimentation with the exception of Moon Creek. Exceedance of the narrative sediment standard is evident in the listed segments and likely others. The critical sedimentation feature is filling of pools by cobble size material. Model results suggest that sediment yield to the system has been curtailed in the past eight years by remedial activities. The Bear, Big, Moon, and Montgomery Creeks and the Upper South Fork watersheds appear to have lower levels of sediment yield based on modeling. However, these watersheds do yield sediment to the South Fork and must be considered in any loading analysis. The loading analysis must be completed basin wide. Since the sediment modeling composes the loading analysis, it is described in Section 2.3 (pages 30-37).

The critical discharge period is the high discharge event, typically associated with a "rain on snow" climatic event. Since sediment is yielded primarily during these large events it is erratic and episodic. For the purposes of a TMDL, sediment loads are stated as tons per year.

Biological, pool volume and the sediment model indicate the unknown pollutant listed for the East Fork Ninemile Creek is sediment. Earlier assessment by DEQ (1998) demonstrates that the metals, cadmium, lead, and zinc are also pollutants. Biological, pool volume and model results indicate that sediment is not impairing Moon Creek.

2.4 Data Gaps

The major data gap is additional in-stream measurement of sediment load. Sufficient measurements were made to assess the accuracy of the model results in the remedial investigation.

3. Subbasin Assessment – Pollutant Source Inventory

Several sources of sediment exist in the valley, including the natural source at approximately 14.7 tons per square mile per year. All the significant sources of sediment are nonpoint sources.

3.1 Sources of Pollutants of Concern

Pollutant sources of sediment are discussed in the following sections. Sediment is yielded to the subbasin from a large number of sources, including the natural erosion rate.

Point Sources

Point sources of sediment include the wastewater treatment facilities and mills. The South Fork Wastewater Treatment District, the City of Smelterville, three mine mills and the Central Treatment Plant discharges have total suspended solids limits In a range of 20 – 70 mg/L. These sources are potentially 7% of the sediment load based on their permits. During the period of 1999 through 2001, their average sediment load was 73.9 tons per year or 1.1% of the sediment load (see Section 2.3, page 30). Compared to sediment loads modeled and verified with in-stream measurements the point source loads are small. The permitted point sources of metals and other pollutants were listed in Table 3 (Section 1.3, page 15). Sixty point sources of metals exist that are not currently permitted. (DEQ-EPA 2000). Since these are ground water sources, none are sediment sources.

The entire subbasin has been considered under CERCLA (Superfund) for impacts of trace metals. Functionally, the site has been interpreted as those locations where the contaminants (trace metals) have come to rest.

Nonpoint Sources

The majority of the land use of the subbasin is forestlands (Figure 3, page 11). Mine and mill site infrastructures, town sites and roads constrain streams leading to sediment yield. These are the two major sources of nonpoint source sedimentation in excess of the natural background erosion rate.

- The meta-sedimentary rocks of the Proterozoic Belt Super-group terrain yield sediment at a natural rate of 0.023 tons per acre per year (14.7 tons per year per square mile). Mass wasting is not a typical feature of the Belt terrain. It can occur on glacial till deposits of valley bottoms. Mass wasting is directly estimated in the CWE process. Little mass wasting was found in the subbasin.

- Timber harvest is a source of sediment, while the cut area remains not stocked with timber species. Once a stand of seedlings and saplings is re-established, the same excess sedimentation from the harvest alone does not occur. Timber harvest, forest fires and smelter fumes (sulfur dioxide gas) deforested a large area of the South Fork Subbasin near Kellogg. Smelter fumes retarded reforestation until 1981 and soil impacts still inhibit reforestation on slopes above the smelters. These areas are not stocked and have higher sediment yield.

- Sediment yield from waste rock piles at mine sites is low; however sedimentation from unconfined tailings deposits can be significant. Sediment is loaded by overland flow, streamside erosion (gradient constraint), and mass wasting.

- Timber harvest and mine site roads are a significant source of sediment. These can yield surface sediment, trigger mass wasting or constrain streams and accelerate erosion. County and state roads and highways can also constrain streams accelerating erosion.

- Urban and suburban areas are a source of sediment. Most urban and suburban areas are in the valley bottoms where slopes are low. These areas are a minor source of sediment yield.

Pollutant Transport

Sediment is delivered to the stream system primarily during high precipitation-high discharge events or rapid snowmelt events. Under these conditions large volumes of sediment move in the stream systems. These conditions develop stream power and stage heights capable of channel alteration. Sediment trapped in upper low order watersheds moves quickly to the higher order streams of the subbasin. Areas where stream gradient is constrained by roads, mine facilities or towns have rapid erosion from bed and/or banks. The gradient of the South Fork Subbasin is sufficient for sediments finer than sand to be flushed to the Coeur d'Alene River (USDA 1994). The eroding substrates of the subbasin are 65 – 75% particles larger than fine sand with a substantial portion of this material at least cobble size. These sediments remain in the South Fork and its lower gradient tributaries where the impact to the beneficial use as pool filling is greatest. A sufficient sediment transport model has not been developed for the South Fork nor have any been found applicable in the remedial investigation process (URS Greiner 2001).

3.2 Data Gaps

The major data gap in sediment pollution is not the sources but rather the transport of sediment in-stream. As a result of the metals contamination of a portion of the subbasin, the sources of metals and sediment are well understood.

Point Sources

Point discharges that have and do not have permits have been monitored in the subbasin. These traditional discrete sources have not been found to be a large sediment source. No data gaps have been identified.

Nonpoint Sources

Nonpoint sources have been modeled rather than measured. Existing in-stream monitoring supports model results; however, additional in-stream monitoring would be of value. Such monitoring is quite expensive (see Section 2.3, page 30). It is unlikely that this data gap will be filled. Model results are the best available information.

4. Subbasin Assessment – Summary of Past and Present Pollution Control Efforts

The wastewater and metals point sources in the watershed were brought under regulation of the National Point Discharge Elimination System (NPDES) during the 1970s. Eleven mining point discharges and three municipal wastewater discharges have been permitted. Most of the permits that are still active are in the process of revision and are expected to be issued early in 2002.

Remedial work on the initial phase of Bunker Hill remedial action is nearly complete. A remedial plan and record of decision were completed in September 1992. A yard removal consent order is being implemented to remove contaminated yards for replacement with clean yard materials. Playgrounds have received similar treatment. A hillside treatment consent order is being implemented to terrace denuded hillsides to slow erosion; fertilize slopes; plant trees, shrubs, and grass; construct check dams to trap eroding materials; and channelize some stream reaches to retard surface water infiltration in the metals-contaminated substrates. The smelter complexes have been demolished and principal threat materials placed in a lined and capped repository. Tailings contaminated sediments have been removed from the South Fork in the Central Impoundment Area and Smelterville Flats reaches. Similar removals have occurred in Government Gulch and Bunker, and Milo Creeks. These materials have been capped in a reshaped Central Impoundment Area. Mine waste rock dumps including the Page and Arizona deposits have been stabilized. Additional phase I work will involve upgrade of the Central Treatment Facility that processes Bunker Hill mine water and replacement of street, sewage collection, and drainage infrastructure.

Additional removal actions have occurred outside the Bunker Hill site area. Tailings deposits at Elizabeth Park and the Success site have been stabilized to prevent mass wasting into the South Fork and East Fork Ninemile Creek. Flood plain sediments contaminated with tailings have been removed from 3.5 miles of Ninemile Creek, 6 miles of Canyon Creek, 1 mile of Moon Creek, and 2 miles of the South Fork in the Osburn Flats reach. Tailings piles have been removed to repositories at the Interstate Site in Ninemile Creek; Dickens Mill Site in Moon Creek; and the Douglas, Denver, Liberal King, and Amy-Matchless Mill sites in the East Fork Pine, and Pine Creeks. Waste rock piles have been stabilized at the Standard-Mammoth, Sydney, and Gertie sites. Removals of metals from ground water seeps and mine adit with semi-passive treatment technologies are in demonstration at the Success and Gem adit sites.

The objective of the majority of the remedial work in the South Fork Coeur d'Alene Subbasin has been to reduce metals concentrations and loads in the streams. The work completed has incorporated removal of sediment sources and re-establishment of channel morphology and structure. Tailings removal either from flood plains or from streamside deposits and waste rock deposit stabilization directly affect sediment yield. The remedial work has not addressed the impacts of forest harvest roads and other infrastructure. Although the remedial activities to date are a good start, these actions are not expected to fully address sediment yield. The forest harvest roads and other infrastructure must be addressed to control sediment yield.

All forest practices conducted in the subbasin are regulated under the Idaho Forest Practices Act Rules and Regulations. These rules are in part best management practices designed to abate erosion and retard sediment delivery to the streams. All Forest Service harvests must meet the INFISH guidelines. These guidelines prescribe 300 feet wide buffers for streams with fishery uses.

5. Total Maximum Daily Load

A TMDL prescribes an upper limit on discharge of a pollutant from all sources so as to assure water quality standards are met. It further allocates this load capacity (LC) among the various sources of the pollutant. Pollutant sources fall into two broad classes: point sources, each of which receives a waste load allocation (WLA); and nonpoint sources, which receive a load allocation (LA). Natural background (NB), when present, is considered part of the load allocation, but is often broken out on its own because it represents a part of the load not subject to control. Because of uncertainties regarding quantification of loads and the relation of specific loads to attainment of water quality standards, the rules regarding TMDLs (40 CFR § 130) require a margin of safety (MOS) be a part of the TMDL.

Practically, the MOS is a reduction in the load capacity that is available for allocation to pollutant sources. The natural background load is also effectively a reduction in the load capacity available for allocation to human made pollutant sources. This can be summarized symbolically as the equation: LC = MOS + NB + LA + WLA = TMDL. The equation is written in this order because it represents the logical order in which a loading analysis is conducted. First the LC is determined. Then the LC is broken down into its components: the necessary MOS is determined and subtracted; then NB, if relevant, is quantified and subtracted; and then the remainder is allocated among pollutant sources. When the breakdown and allocation is completed we have a TMDL, which must equal the LC.

Another step in a loading analysis is the quantification of current pollutant loads by source. This allows the specification of load reductions as percentages from current conditions, considers equities in load reduction responsibility, and is necessary in order for pollutant trading to occur. Also a required part of the loading analysis is that the LC be based on critical conditions – the conditions when water quality standards are most likely to be violated. If protective under critical conditions, a TMDL will be more than protective under other conditions. Because both LC and pollutant source loads vary, and not necessarily in concert, determination of critical conditions can be more complicated than it may appear on the surface.

A load is fundamentally a quantity of a pollutant discharged over some period of time, and is the product of concentration and flow. Due to the diverse nature of various pollutants, and the difficulty of strictly dealing with loads, the federal rules allow for "other appropriate measures" to be used when necessary. These "other measures" must still be quantifiable, and relate to water quality standards, but they allow flexibility to deal with pollutant loading in more practical and tangible ways. The rules also recognize the particular difficulty of quantifying nonpoint loads, and allow "gross allotment" as a load allocation where available data or appropriate predictive techniques limit more accurate estimates. For certain pollutants whose effects are long term, such as sediment and nutrients, EPA allows for seasonal or annual loads.

5.1 Instream Water Quality Targets

The in-stream water quality target for the South Fork Coeur d'Alene River TMDL is full support of the cold water designated use (Idaho Code 39.3611, 3615). Specifically, sedimentation must be reduced to a level where the stream can re-establish residual pool volume and trout density in the range of 0.1-0.3 trout per square meter found in control streams (DEQ 2001c). Unfortunately, a defensible mathematical relationship between residual pool volume and fish density has not been developed for this or other watersheds. The TMDL will develop loading capacities in terms of mass per unit time. The interim goals will be set based on watersheds supporting cold water use and final goals established when bio-monitoring establishes full support of the cold water use. The sources yielding sediment to the system can be reduced, but a substantial period (20-30 years) will be required for the stream to clear its current sediment bed load and create pools.

Design Conditions

Point sources are not the major sources of sediment to the South Fork Coeur d'Alene Subbasin, but are a significant source. The permitted facilities can discharge an average 12.5 million gallons per day (7.32 cfs). Based on the average permit limits for total suspended solids (Table 21), the potential discharge load is 470 tons per year. This level is 7% of the total load of 6,699 tons per year (Table 17). Actual discharge is a fraction of this (1.1%; Table 13, page 31).

The TMDL addresses the point and nonpoint sediment yield to the subbasin. Point discharge of sediment is relatively constant. Sediment from nonpoint sources is loaded episodically, primarily during high discharge events. These critical events occur during the November through March period, but may not occur for several years. The return time of the largest events is 10-15 years (DEQ 2001c). The key to nonpoint source sediment management is implementation of remedial activities prior to the advent of a large discharge event.

Seasonality and Critical Conditions

The condition for sediment delivery and additional sedimentation of the streams of the South Fork Coeur d'Alene Subbasin is the high discharge event. The flood frequency analysis and history indicate that extreme high discharge events occur at 10 to 15-year intervals (section 2.3; page 22; DEQ 2001c). Lesser high discharge events yield less sediment to the system. The largest high discharge events of record are "rain on snow" events that occur between November and March of any given year. However, these events may not occur for several years. As an example no major rain on snow events occurred between November 1990 and mid-February 1995 in the Coeur d'Alene Basin. After the 1995 event, two additional events occurred in 1996, one the third largest event on record, and then no event occurred of any size until January 2002. Thus the most likely situation for sediment loading is episodic not seasonal. High discharge does occur seasonally with the spring snowmelt. These seasonal high discharges are not the large discharge events triggering high sediment yields that develop under rain on snow conditions. With this understanding of sedimentation events, the sediment yield reductions required by the TMDL will be realized when the critical discharge event occurs.

Critical conditions are part of the analysis of loading capacity. The beneficial uses in this subbasin are impaired due to chronic sediment conditions. Due to the chronic condition, this TMDL deals with yearly sediment loads. The concept of critical conditions is difficult to reconcile with the impact caused by sediment. The critical condition concept assumes that under certain conditions, chronic pollution problems become acute pollution problems and therefore we need to ensure that acute conditions do not occur. The proposed sediment reductions in the TMDL will reduce the chronic sediment load and also reduce the likelihood that an acute sediment loading condition will exist. It is in this way that we have accounted for critical conditions in the TMDL.

Target Selection

The TMDL applies sediment allocations in tons per year and calculates sediment reduction goals. Since the lower reaches of the South Fork are impaired by sediment, reduction will be required from many sub-watersheds of the basin. The implementation plan may apply surrogate measurement of success. Residual pool volume is the surrogate measure that is best related to fish requirements and fish density increase.

Several watersheds (Big, Terror, Moon, Montgomery, and Bear Creeks) of the subbasin are at levels of sediment contribution that are 20% or less above background. These watersheds have high residual pool volume and fish populations that are at the density of control areas (0.1-0.3 trout/m^2). Further reductions of sediment yield will be required from the remaining watersheds that are above 25%. Reductions from the middle and lower gulches area must be tempered with the fact that infrastructure such as Interstate 90 and the towns of Wallace, Osburn, and Kellogg will not be removed. Reductions in these watersheds of 75% to 100% of the current yield is likely the best that can be achieved without removal of the existing infrastructure.

Based on those watersheds where cold water use is supported and residual pool volumes are adequate (Upper South Fork, Big, Moon, Montgomery, and Bear Creeks) and tempered by the existing human infrastructure in some watersheds, the interim TMDL goal is set at 25% above background. The goal should be attained following two high flow events after implementation plan actions are in place. This is on an average 30 years. This time is necessary to have the channel forming events to export sediment and to create pool structures.

Monitoring Points

Five points of compliance are set. These are Canyon Creek near its mouth, Ninemile Creek near its mouth, Pine Creek near its mouth, the South Fork at Big Creek and the South Fork at Pinehurst.

Sediment load reduction from the current level (52% above background) toward the 25% above background sediment yield reduction goal is expected to attain a sediment load that is not yet quantified, but will fully support beneficial use (cold water biota). This sediment load will be recognized through monitoring by the following appropriate measures of full cold water biota support:

- three or more age classes of trout, including young of the year,
- trout density levels of 0.1-0.3 fish/square meter,
- presence of sculpin and tailed frogs, and,
- a macro-invertebrate biotic index score of 3.5 or greater.

When the final sediment loading capacity is determined by these appropriate measures of full cold water biota support, the TMDL will be revised to reflect the established supporting sediment yield.

5.2 Load Capacity

The load capacity for a TMDL designed to address a sediment-caused limitation to water quality is complicated by the fact that the state's water quality standard is a narrative rather than a quantitative standard. In the waters of the South Fork Coeur d'Alene River Subbasin, the sediment interfering with the beneficial use (cold water biota) is most likely large bed load particles. Adequate quantitative measurements of the effect of excess sediment have not been developed. Given this difficulty, a sediment loading capacity for the TMDL is difficult to develop. This TMDL and its loading capacity are based on the following premises:

- sediment yield less than 25% above background will fully support the beneficial uses of cold water biota,
- the stream system has some finite yet not quantified ability to process (attenuate through export and/or deposition) a sediment yield rate greater than 25% above background rates,
- beneficial uses (cold water biota) will be fully supported when the finite yet not quantified ability of the stream system to process (attenuate) sediment is met, and
- care must be taken to control factors, such as fish harvest, that may interfere with the quantification of beneficial use support.

The natural background sedimentation rate is the sediment yield prior to development of the subbasin. It was calculated by multiplying the watershed acreage by the sediment yield coefficient for coniferous forests (0.023 tons/acre/year). The estimate assumes the entire watershed is vegetated by coniferous forest prior to development. The calculated estimated value for the entire South Fork is 4,406 tons per year. Thus, the 25% above background sediment yield goal is 5,507 tons per year for the entire watershed. This goal is supported by the sediment yield rates of 15-19% above background modeled for the Upper South Fork, Big, Moon, and Montgomery Creeks watersheds (See Table 16; page 34). These watersheds contain streams that have high residual pool volumes (See Table 11; page 29) and fish densities (See Table 9; Page 26). The goal of 5,507 tons per year is an estimated goal that will be replaced by the final sediment goal, when the criteria for full support of cold water biota designated on the page 47 are met. The loading capacities based on the projected goal at each point of compliance are provided in Table 18. Loading capacities were developed by calculating background sedimentation based on acreage above the point of compliance. An additional 25% of the value was added to develop the loading capacity.

Table 18: Loading capacity at the points of compliance.

Location	Acreage of watershed	Loading capacity at 25% above background (tons/year)
Canyon Creek	13,787	397
Ninemile Creek	7,355	212
Pine Creek	50,855	1,462
South Fork Coeur d'Alene River at Big Creek Bridge	84,232	2,422
South Fork Coeur d'Alene River at mouth.	191,558	5,507

5.3 Estimates of Existing Pollutant Loads

Point sources of sediment are from the 9 permitted facilities and the Central Treatment Plant. As stated in Section 5.1 the point sources at maximum permitted discharge account for 470 tons per year of fine sediment. This amount is potentially 7% of the load. The actual average discharge for the past three years is 74 tons per year or 1.1% of the load. The sediment discharged is fine sediment that does not interfere with the cold water use. DEQ believes that current sediment discharge limits are adequately protective of the designated uses. The actual discharge is 16% of that potential under the permits. Thus a small reserve can be created from the permitted discharges by uniformly removing 10% of their potential sediment loading. The waste load allocation is set at the existing potential discharge 470 tons per year. However reducing the allocated waste load to each source by 10% creates a reserve of 47 tons per year and a daily discharge 1.55 MGD. The TSS limit is not lowered in the permits, the discharge volume is.

Nonpoint sources of sediment yield were estimated in Section 2.3 (Table 17; page 36). These estimates are made using the assumptions and model approach fully documented in Appendix A. The model spreadsheets are provided in Appendix B. Loading rates are based on land use; road, and mine facility impacts (see Section 2.3; Table 14; page 32) and Appendices A and B). Estimated sediment loads from the watersheds above the points of compliance are shown in Table 19.

The loading area of various sources is provided in Table 20. It is assumed for the purposes of these calculations that the loading from roads is directly proportional to the area in a specific land use.

Table 19: Sediment loads from nonpoint sources in South Fork Coeur d'Alene Subbasin.

Load Type	Location	Load	Background	Estimation Method
Sediment	Canyon Creek	443	317	Model
Sediment	Ninemile Creek	241	169	Model
Sediment	Pine Creek	2,339	1,171	Model
Sediment	South Fork Coeur d'Alene River at Big Creek Bridge	2,544	1,937	Model; Discharge records
Sediment	South Fork Coeur d'Alene River at mouth	6,678	4,399	Model; Discharge records

Table 20: Sediment loading proportion based on area in various land uses.

Watershed	Canyon Creek		Ninemile Creek		Pine Creek		South Fork Coeur d'Alene River at Big Creek Bridge		South Fork Coeur d'Alene River at mouth	
	acres	%	acres	%	acres	%	acres	%	acres	%
Timber Lands	13,539	98.1	7,250	98.5	49,921	98.2	81,096	96.3	183,493	95.9
Mined Lands	76	0.6	39	0.5	71	0.1	266	0.3	359	0.2
Urban Lands	21	0.2	2.7	0.1	545	1.1	1,503	1.8	4,616	2.4
Paved Roads	151	1.1	63	0.9	310	0.6	1,367	1.6	2,823	1.5
Total	13,787	100	7,355	100	50,856	100	84,232	100	191,291	100

5.4 Pollutant Allocation

The pollutant allocation is comprised of the loading capacity minus the margin of safety and the background. A pollutant allocation would be comprised of the waste load allocation of point sources and the load allocation of nonpoint sources. Since the point sources are negligible, the sediment TMDL has a waste load allocation set at 90% of the current permit levels. From the 10% load removed from each point source, a small reserve is created.

Margin of Safety

The permit limits of the point sources are set conservatively providing a margin of safety. The margin of safety is implicit in the model used. The model is estimated to be 231% conservative when applied on the Belt terrain (Appendix A). This level of conservative assumptions provides an over-estimation of sediment yield. The over-estimation is the implicit margin of safety. Given the conservatively high estimations developed by the model no additional explicit margin of safety is deemed necessary.

Background

The background for each watershed is shown in Tables 17 and 19. The background is treated as part of the loading capacity and is allocated as part of the loading capacity below. Any unknown unallocated point sources would be included in the background portion of the allocation.

Reserve

A reserve waste load is allocated for future point discharge. The reserve is modest amounting to a discharge of 20 mg/L total suspended solid and 1.55 MGD (Table 21). This is a reserve of 47 tons/year. The reserve is developed from the existing permitted sources by trimming each waste load allocation by 10%. Data developed from discharge monitoring reports of calendar years 1999-2001 demonstrate that these sources discharged only 15.7% of the load allocated to them in their existing permits (Table 13; page 31). The 10% load reduction to the permitted sources can be met by trimming water discharge limits rather than total suspended solids limits. The Page and Mullan wastewater treatment facilities should trim discharge as these facilities deal with the inflow and infiltration of their collection systems.

Remaining Available Load

The remaining available load is allocated between the point sources (waste load allocation) and the nonpoint sources (load allocation).

Waste Load Allocation

The waste load allocation of the point sources is set at the current permit limits. A small reserve is included in the waste load allocation. These are provided in Table 21.

Load Allocation:

The load allocation is shown in Table 22a-e. The allocation is based on the modeled estimate of nonpoint source sediment contribution of 5,036 tons per year (Estimated sediment load (5,507) –waste load allocation (471) and a reduction to 25% above background exclusive of the point sources contribution. The exclusion of the point sources is based on the fact that these sources discharge fine sediment, while coarse sediment appears to be interfering with the cold water use by filling pools. The margin of safety is applied to the allocations at the points of compliance. The allocation includes the background sediment yield that is shown in Table 18. A 15-year time frame is provided to meet allocations in the tributary watersheds, while a 30-year time frame is provided in the main channel of the South Fork. These time frames permit one and two large channel forming events to occur in the tributaries and main stem, respectively.

Table 21: Waste load allocation to the Permitted Point Discharges of the South Fork Coeur d'Alene River Subbasin.

Permitted Discharge	Total Supended Solids Limit (mg/L)	Average Discharge (MGD)	Revised Discharge Limit (MGD)	Annual Average Load	Revised Annual Load (tons/yr)
Page	30	2.8	2.52	127.8	115.0
Mullan	30	0.28	0.26	13.7	12.3
Smelterville	70	0.18	0.23	27.3	24.6
Coeur/Galena 001	20	1.36	1.21	41.0	36.9
Coeur/Galena 002	20	0.53	0.48	16.2	14.6
Coeur/Caladay	20	0.3	0.27	9.1	8.2
Lucky Friday 001	20	1.65	1.48	50.1	45.1
Lucky Friday 003	20	1.26	1.13	38.2	34.4
Sunshine	20	2.8	2.52	85	76.5
Central Treatment Plant	20	2.05	1.85	62.3	56.1
Reserve	20	-	1.55	-	47.0
Total	-	13.21	13.5	470.7	470.7

Table 22: Sediment load allocation and load reduction required at the points of compliance.

a) Canyon Creek Allocation[1]

Source	Percentage of load source	Load allocation (tons/year)	Load reduction required (tons/year)	Time frame for meeting allocations
Timber Lands	98.1	389.5	45.1	15 years
Mined Lands	0.6	2.4	0.3	15 years
Urban Lands	0.2	0.8	0.1	15 years
Paved Roads	1.1	4.4	0.5	15 years
Total	100	397[2]	46	-

[1] Allocation for Canyon Creek segment 3525; [2] Loading Capacity with no point sources.

b) Ninemile – East Fork Creek Ninemile Allocation[1]

Source	Percentage of load source	Load allocation (tons/year)	Load reduction required (tons/year)	Time frame for meeting allocations
Timber Lands	98.5	208.8	28.4	15 years
Mined Lands	0.5	1.1	0.1	15 years
Urban Lands	0.1	0.2	0.1	15 years
Paved Roads	0.9	1.9	0.4	15 years
Total	100	212[2]	29	-

[1] Allocation for Ninemile Creek segments 3524 and 5618; [2] Loading Capacity with no point sources.

c) Pine-East Fork Pine Creek Allocation[1]

Source	Percentage of load source	Load allocation (tons/year)	Load reduction required (tons/year)	Time frame for meeting allocations
Timber Lands	98.2	1,435.6	861.2	15 years
Mined Lands	0.1	1.5	0.9	15 years
Urban Lands	1.1	16.1	9.6	15 years
Paved Roads	0.6	8.8	5.3	15 years
Total	100	1,462[2]	877	-

[1] Allocation for Pine Creek segments 3519, 3520, and 3521; [2] Loading Capacity with no point sources.

d) South Fork Coeur d'Alene River at Big Creek Bridge[1]

Source	Percentage of load source	Load allocation (tons/year)	Load reduction required (tons/year)	Time frame for meeting allocations
Timber Lands	96.3	1,600	191.2	30 years
Mined Lands	0.3	5.0	0.6	30 years
Urban Lands	1.8	29.9	3.6	30 years
Paved Roads	1.6	26.6	3.2	30 years
Total	100	1,661.5[2]	198.5[3]	-

[1] Allocation for South Fork Coeur d'Alene segments 3516, 3517, and 3518.
[2] Loading capacity of South Fork at Big Creek (2,422) – loading capacities of Canyon (397) and Ninemile (212) Creeks- waste load allocation (151.5).
[3] Load reduction of South Fork at Big Creek (122) – loading capacities of Canyon (46) and Ninemile (29) Creeks + wasteload allocation (151.5)

e) South Fork Coeur d'Alene River at mouth[1]

Source	Percentage of load source	Load allocation (tons/year)	Load reduction required (tons/year)	Time frame for meeting allocations
Timber Lands	95.9	1,431.6	282.6	30 years
Mined Lands	0.2	3.0	0.6	30 years
Urban Lands	2.4	35.8	7.1	30 years
Paved Roads	1.5	22.4	4.4	30 years
Total	100	1,492.8[2]	294.7[3]	-

[1] Allocation for South Fork Coeur d'Alene segments 3513, 3514. And 3515 and Government Gulch 5084.
[2] Loading capacity of South Fork at mouth (5,507) – loading capacities of Canyon (397), Ninemile (212), Pine (1,462) Creeks and the South Fork above Big Creek (1,661.5)- waste load allocation (319.2)
[3] Load reduction of South Fork at mouth (1,171) – loading capacities of Canyon (46), Ninemile (29), Pine (887) Creeks and the South Fork above Big Creek (233.5) + waste load allocation (319.2)

Reasonable Assurance of Load Allocation Implementation

The federal government manages 51.7% of the land in the South Fork Coeur d'Alene River Subbasin. The state manages an additional 3.9%. A CERCLA remedial action is planned to address mining impacts in the watershed. The CERCLA actions must address the TMDL as an applicable regulatory requirement assuring that sediment as well as metals is addressed. Federal land management actions make sedimentation reduction a priority. IDL has been directed by a gubernatorial executive order to implement state developed TMDLs on lands that they manage directly or oversee implementation of the Forest Practices Act. These actions will provide reasonable assurance that the load allocations will be implemented. The CERCLA action, federal management direction and executive order should assure implementation plan development. The plan will be implemented based primarily on the budgetary constraints of the federal and state agencies.

Monitoring Provisions

In-stream monitoring of the beneficial use (cold water biota and salmonid spawning) support status during and after implementation of sediment abatement projects will establish the final sediment load reduction required by the TMDL. In-stream monitoring, which will determine if the threshold values identified in Section 5.1 (page 47) have been met, will be completed every year on a randomly selected 1% of the watershed's Rosgen B channel types. Monitoring will assess stream reaches of at least 40 times bank full width in length. These reaches will be randomly selected from the total stream channel in B types until at least 5% of these channels have been assessed after five years. Identical measurements will be made in appropriate reference streams where beneficial uses are supported. Data will be compiled after five years. The yearly increments of random testing that sum to 5% of the stream after five years should provide a database not biased by transit fish and macroinvertebrate population shifts. Based on this database the beneficial use support status will be determined.

Feedback Provisions

When beneficial use (cold water use) support meets the full attainment level, further sediment load reducing activities will not be required in the watershed. The interim sediment loading capacity will be replaced in a revised TMDL with the ambient sediment load. Best management practices for forest and mining practices will be prescribed by the revised TMDL with provisions to maintain erosion abatement structures. Regular monitoring of the beneficial use will be continued for an appropriate period to document maintenance of the full support of the beneficial use (cold water biota).

If the sediment reduction goal is met, but the recovery of the beneficial use does not occur an additional sediment reduction would be required. Since the South Fork Coeur d'Alene River watershed contains a large amount of infrastructure in narrow valleys (Interstate 90, Kellogg, Wallace, industrial facilities, and transportation corridors), the social and economic impacts of further reductions would require assessment. This analysis would be completed in a use attainability assessment to determine if the beneficial uses of the stream are attainable given the level of development.

5.5 Conclusions

The assessment of the South Fork Coeur d'Alene Subbasin shows by a preponderance of fisheries, residual pool volume, and sediment modeling results that the South Fork Coeur d'Alene River below the Canyon Creek confluence and Canyon, Ninemile, and Pine Creeks have sediment impairment of the cold water use. Moon Creeks, which is also listed, does not have the impairment when assessed with the identical indicators. Sediment model results are 1.5 to 3 times lower than in stream measurements. The estimations in stream were likely shifted upwards by the remedial work that disturbed the stream beds while the estimates were in progress. The model results are lower as a result of the incorporation of improvements made as part of metals remedial actions.

A sediment TMDL is prepared for the South Fork Coeur d'Alene River below the Canyon Creek confluence, Canyon, Ninemile, and Pine Creeks. The TMDL sets a goal of 25% above natural background sediment yield based on sediment yield from watersheds of the subbasin fully supporting cold water beneficial use. A loading capacity is set based on this goal. An implicit margin of safety of 231% is applied in the sediment model. The waste load allocation to point discharges is set at the current level. The loading capacity is allocated on a land use basis between timber harvest, mining, urban-suburban, and paved road land uses.

The upper two segments of the Coeur d'Alene River (NF-SF Confluence to French Gulch, 17010303 4021 and French Gulch to Skeel Gulch 17010303 4018) have accumulated sediment from the North and South Forks of the Coeur d'Alene River. Immediately below Skeel Gulch, the gradient of the river is 0.045% and hence the river is incapable of transporting particles larger than fine sand. The sediment loads of the North and South Fork have their origin in a combined 1,193 square mile watershed, while the watershed of the river immediate to the upper two segments is a 25 square mile watershed. The watersheds of the North and South Forks of the Coeur d'Alene River are 98% of the source area, while those immediate to the river are 2%. Clearly the sediment load to the upper segments of the Coeur d'Alene River is from the two tributary watersheds not from the small immediate watershed of these two segments.

The North Fork TMDL sediment limitations will reduce a sediment load estimated at 134% above background (30,379 tons per year) to 50 % above background (19,641 tons per year). This level of reduction should over time decrease the sediment load to the Coeur d'Alene River by an equal amount. The South Fork Coeur d'Alene sediment TMDL limitations will reduce a sediment load estimated at 52% above background (6,699 tons per year to 25% above background (5,507 tons per year). Again this benefit will be transferred over time to the upper two segments of the Coeur d'Alene River. An over estimation of the sediment yield of the remaining 25 square mile watershed of the upper two Coeur d'Alene River segments is 800 tons per year. This is 117% above the 368 tons per year background level from an area that contains some roadless lands. Given this assumption, the segments would have sediment levels in the range of 47% above background ([19,641 t/yr +5,500 t/yr+500 t/yr]/17,929) after the limitations of the North and South Fork TMDLs are realized. The levels of reductions from the majority of the watershed (98%) will reduce the sediment level of the Coeur d'Alene River over time to sediment levels (47% above background or less) that are expected to support its beneficial uses.